PRACTICAL APPLICATIONS FOR CONSTRUCTION AND THE BUILT ENVIRONMENT

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IN THIS ISSUE

A best fit solution for side weirs

Engineers at HR Wallingford and Mott MacDonald have developed a new design procedure for side weirs as part of a project carried out under DTI's Partners in Innovation programme. The design procedure, along with general advice on the correct use of such structures, will be published as a Manual by Thomas Telford this spring.

Side weirs divert flow from main channels into side channels when water levels exceed a given limit. In the UK they are used to:

- prevent flooding in rivers by diverting flow into temporary off-stream storage or diversion channels;
- discharge storm water at overflows in combined sewers;
- divert or divide flows within water and wastewater treatment works;
- discharge excess flows from canals and navigation channels.

Overseas, side weirs are also used to regulate flows in irrigation systems.

Though side weirs are important water control structures, their hydraulic design is complex. Flow conditions vary with distance along the weir and do not conform to simple weir theory.

Richard May of HR Wallingford coordinated HRW's input to the Manual. 'We analysed published data from 470 separate tests on side weirs in order to identify the key issues affecting their performance,' he explains. The data were used to calibrate coefficients in the momentum form of the one-dimensional flow equation that describes flow over a side weir. Numerical solutions of this equation were then used to extend the range of flow conditions considered and also to develop simplified prediction methods.

The results from the study are presented as graphs and equations that can be used to determine directly the amount of flow spilled by a side weir and the overall variation in water level along the weir. The Manual also includes more-general chapters covering the layout, operation, maintenance and safety of side weirs, and should be a useful tool for anyone dealing with the design of such structures.

HR Wallingford is organising a one day Workshop on Side Weirs and Culvert Design during 2003. For further details including registration, please contact Jackie Harrop on 01491 822389 or visit training@hrwallingford.co.uk.

(Top) River Exe side weir with no flow and (Above) in flood

For further information please contact Richard May (01491 822251; E-mail: rwpm@hrwallingford.co.uk).

An international perspective – advanced acoustics facilities in France

The research community is international and Sir John Fairclough, in Rethinking Construction Innovation and Research, recommended a much stronger effort be made to tap the world's investment in research and innovation. Collaboration in Europe has been stimulated greatly by the Framework programmes of the European Commission, and many universities and research centres in the UK (although relatively few firms) have participated in projects under successive Frameworks. The Sixth Framework, now starting, offers new opportunities for collaboration in research while the various innovation programmes of the European Commission facilitate the exploitation of research across Europe. With these opportunities in mind, this article looks at an aspect of construction research in Europe.

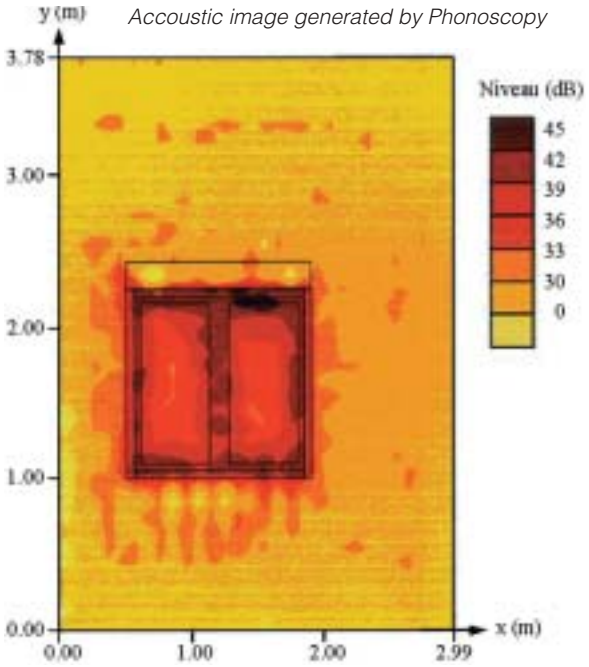
CSTB (Centre Scientifique et Technique du Bâtiment – www.cstb.fr) is the French equivalent to BRE. With noise levels becoming a key issue in the design of buildings and urban areas, it has invested heavily in new facilities for acoustics research. Two CSTB developments are summarised below.

The first is 'Phonoscopy', described by CSTB as 'an acoustical imaging tool'. This analyses the sound transmitted through a wall panel or window assembly and provides a map of the sound intensity transmitted through each small area of the panel in one-third-octave frequency bands. It also provides a visual image of the way in which vibrations are propagating in the panel or assembly. By examining these outputs, the elements responsible for most sound transmission can be identified, and remedial action taken.

To obtain the measurements, the wall or window is mounted within an acoustic chamber. On one side of the panel, sound is produced by a loudspeaker and on the other, within an anechoic enclosure, a microphone is mounted on a robotic arm a few cm from the wall. This takes the measurements at points on a 100mm grid parallel to the wall. The measurements can then be combined and analysed (rather as in medical X-ray tomography) to provide a picture of the noise distribution at the wall and of the vibrations within the wall.

While Phonoscopy has been developed for testing construction products, it is equally applicable to products used in transport or industrial applications.

The second CSTB facility creates 3D sound, which can be associated with visual images to provide 'acoustic virtual reality'. The mechanisms of sound propagation in an internal space or external environment have been studied for many years, and many facilities and computer models have been developed for analysing these. Deriving the consequent sound experience involves integrating the characteristics of the sources and the different propagation routes with human processes of hearing, which provide intensity, pitch and directional information. In particular, the difference in the sound received by each ear, including the way that it is modified by the person's head and body, is crucial. CSTB have developed and patented means of simulating the acoustic fields at each ear, based on the positions and characteristics of the sources and propagation routes.



Accoustic image generated by Phonoscopy

This system is now being incorporated in the seating in a 'virtual environment hall' at CSTB's facility at Sophia Antipolis. The users of a future building can be 'immersed' in the building, assessing not only its acoustics but also other aspects its internal environment (lighting, thermal comfort etc) before any work starts on site.

For further information about the Sixth Framework, contact the National Contact Point for materials, processes etc: (020 8943 6660; E-mail: nmphelp@npl.co.uk).

For further information on Phonoscopy, contact Michel Villot at CSTB Grenoble (+33 4 76 76 25 13; E-mail: villot@cstb.fr).

For further information on 3D sound contact Jacques Martin at CSTB Grenoble (+33 4 76 76 25 44; E-mail: j.martin@cstb.fr).

Article supplied by Roger Courtney (01923 446767;E-mail: roger.courtney@ntlworld.com).

Managing bridges with sub-standard shear studs

TRL has been commissioned by the Highways Agency to review the assessment rules for shear studs and to examine techniques for inspection and monitoring of shear studs in service.

Assessment of composite bridges has identified a number of cases where the shear studs are theoretically deficient when checked for strength, serviceability or fatigue. The lack of evidence of shear stud failure in service indicates that the rules for design and assessment are conservative. Sources of conservatism, which have not been taken into account in the assessment, are bond and friction between steel and concrete, and the flexibility of the studs, which both contribute to reduction of longitudinal shear load.

TRL has undertaken a series of laboratory tests (see picture) to investigate the performance of shear studs under static and cyclic loading. Acoustic emission has been used to detect areas where damage to the shear connection has started. Inspection of the shear studs and welds may then be possible using ultrasonic scanning techniques.

For further information please contact John Lane at TRL (01344 7700 527; fax: 01344 770 356; E-mail: jlane@trl.co.uk).

Lighting in hospitals

Lighting is of critical importance in hospitals. An adequate level of lighting is essential if even basic tasks are to be carried out. Good, carefully-designed lighting can make a big difference to the appearance of a hospital, and can be highly cost-effective.

The CIBSE Lighting Guide 'Hospitals and health care buildings' gives detailed guidance on the functional aspects of lighting for clinical areas. But the lighting appearance, including that in non-clinical areas such as receptions, corridors and waiting rooms (see picture), is vital too if spaces are to be attractive and welcoming.

For these reasons, the Department of Health/NHS Estates R&D programme has funded BRE and South Bank University to develop detailed guidance on the visual environment in hospitals. A publication 'Lighting and colour in hospital design' is being drafted.

Both daylight and electric light play a part. As well as daylight, windows provide a view out, contact with the outside world, and access to sunlight. All three aspects can have a therapeutic effect on patients. Windows should therefore be sized and positioned to provide a good view out as well as an average daylight factor of 2–5%. Good, controllable solar shading is essential.

Electric lighting design will concentrate on the appearance of spaces with light on walls and ceilings, as well as to provide glare-free lighting on tasks (see 2nd picture). Lighting equipment should integrate with the architectural design of the building and the daylight within it.

Hospitals must also have emergency escape lighting that switches on automatically in a power failure. Some areas may need standby lighting to enable procedures to be continued or may need to shut down safely.

A proper maintenance plan needs to be drawn up at the design stage, and carried out at regular intervals, to keep a high-quality visual environment following installation or refurbishment.

In waiting areas a combination of lighting gives an informal atmosphere.

A combination of uplighting and downlighting can give a bright environment with enough light for patients to read.

Efficient lamps, ballasts and luminaires, with appropriate lighting controls, can be highly cost-effective and help meet NHS energy targets. When lighting is planned, it is essential to consider the running costs over the life of the installation as well as its capital cost.

A properly designed visual environment, with the appropriate use of colour and lighting, will have important benefits in hospitals. A small investment in good lighting design can provide improved environmental quality, and savings in running costs, over many years.

For more information please contact Paul Littlefair at BRE (01923 664874; fax: 01923 664095; E-mail: littlefairp@bre.co.uk).

BRE

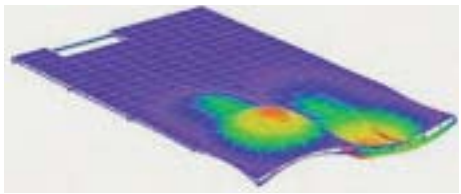
STRUCTURES

Help invited on the vibration of floors

The Steel Construction Institute (SCI) is half way through a 3-year European Coal and Steel Community (ECSC) research project on the vibration of steel and composite floors, with partners from Germany, Luxembourg and The Netherlands. The objective of this project is to produce a general design guide that, it is hoped, will receive the status of an acknowledged European guideline for owners, specifiers, architects and engineers. It is also anticipated that this will be a key influence on CEN limits for floor vibrations and future revisions to the Eurocodes.

The SCI, in collaboration with Arup Advanced Technology Group (ATG), has undertaken finite element analyses on a wide range of floors that have been subjected to vibration tests. This will enable us to gain a better understanding of their behaviour and examine how values obtained from current floor vibration prediction techniques compare with the measurements. On completion of these comparisons, work will begin on developing simple rules for inclusion within the final design guide.

Although a majority of the modelling work has now been completed, the SCI would like to invite designers to send reports on measurements that have been undertaken on real floors. This will supplement the test information that has already been gathered and help to ensure that a wide range of floor types will be covered in the forthcoming guidance. Due to the fact that some of this information may be of a sensitive nature, any submissions will be treated in the strictest confidence by the SCI.



Finite element model showing the first mode of vibration for the first floor at the SCI headquarters

The SCI is being supported in this work by Corus Construction and Industrial, Westok Ltd. and Arup ATG.

For further information please contact Dr Stephen Hicks at The Steel Construction Institute (01344 623345; E-mail: s.hicks@steel-sci.com).

Overtopping and coastal flooding

With global warming and the threat of increased storminess, design and analysis methods for coastal defences need to keep pace with the demands for safe housing, working or travelling close to coasts. Researchers in a collaborative European project called CLASH* are developing methods to predict how defences can limit overtopping, and to improve guidelines for crest level design.

CLASH is organised within the EC 5th Framework Programme. It involves 12 European partners, including HR Wallingford, coordinated by the University of Ghent. HRW's contribution is jointly funded by DEFRA & EA under the 'Coastal Flooding Hazard and Wave Overtopping' project.

HRW is participating in five of the ten work packages within CLASH. During their research, staff will be measuring storm overtopping at a monitoring site in Kent, then using these data to validate prediction techniques, as well as analysing hazards faced by people at risk from overtopping.

HRW staff will deploy storm water collection equipment behind the vertical seawall at Samphire Hoe, an amenity reclamation formed using Chalk Marl from the Channel Tunnel. It provides a suitable test site since it has no resident community and access is restricted during bad weather.

These field measurements will be compared with data from physical model tests at HRW as well as empirical and numerical model predictions. This should highlight any scale or model effects inherent in existing predictive tools and suggest ways of dealing with them.

Severe wave overtopping at the Samphire Hoe seawall. (Courtesy of Eurotunnel and The White Cliffs Countryside Project)

For further information please contact Dr Tim Pullen (01491 822231; e-mail: t.pullen@hrwallingford.co.uk). See also www.clash-eu.org.

*CLASH stands for Crest Level Assessment of coastal Structures by full scale modelling, neural network prediction and Hazard analysis on permissible wave overtopping.

HIGHWAYS

Salt spreading on UK roads

In 2001, the National Salt Spreading Research Group (NSSRG) commissioned TRL to undertake independent salting trials to advance the understanding of salt spreader performance and effective highway de-icing.

Eight performance trials in controlled conditions, followed by live road trials, have been completed. These have studied 3mm, 6.3mm and 10mm grades of salt, either as pre-wetted or dry, distributed from four different spreaders. The efficacy of the pre-wetted salting operation – using dry rock salt plus a 23.5 per cent solution of brine in the ratio of 70:30 dry salt to brine – has been compared to that of dry salt.

The performance has been evaluated for parameters such as:

- salt recovery;
- salt moisture content;
- measurement of chloride content in the distributed salt;
- transverse and longitudinal 'snaking';
- the effect of salt grain size on salt distribution;
- wastage to the roadside edge;
- trafficking and,
- road geometry.

An interim report of the findings from the performance trials in controlled conditions is available on the NSSRG website (http://www.trl.co.uk/nssrg/).

Evidence from the trials should assist authorities with operational decisions concerning the set up of their spreaders, leading to greater efficiency, cost savings, improved service delivery, and safety and environmental benefits.

Spreader discharging salt onto the road surface during tests

For further information please contact Marilyn Burtwell at TRL (01344 7700214; E-mail: mburtwell@trl.co.uk).

New standards for concrete

The current British Standard for the specification of concrete (BS 5328) is due to be withdrawn in December 2003, and will be replaced by the European Standard EN 206-1:2000 together with its complementary British Standard BS 8500:2002:Parts 1 & 2. A consortium of 17 industry organisations, led by the British Cement Association, has produced a series of web-based documents to help designers and specifiers to use the new standards.

The new standards for concrete specification include a number of changes in both approach and terminology compared to the current British Standard. To help designers and specifiers achieve a smooth transition between old and new standards, a recently completed Partners in Innovation project supported by DTI, led by BCA, has produced a series of guidance documents on the effective use of the new standards. These documents, available for free download at www.bca.org.uk /activities/matstand, cover:

- specification of constituent materials;
- specification of concrete for normal uses;
- guide to the selection of concrete quality and cover to reinforcement;
- examples of the specification of concrete;
- concrete for specific applications (i.e. concrete floors, visual concrete, coloured concrete, lightweight concrete and concrete exposed to chemical attack);
- European replacements for British Standards on concrete and its materials.

In addition to these guidance documents, a further document has been produced, combining the requirements of both EN 206-1 and BS 8500, together with an informative commentary. This will be published as a BSI report later this year and form a single volume reference for designers and specifiers.

It is hoped that as many specifiers as possible, as well as others involved in construction practice or teaching, will take this opportunity to familiarise themselves with the content of these new standards before they become fully effective.

For further information please contact Dr Bill Price at the British Cement Association (01344 725705; E-mail: wprice@bca.org.uk).

Best practice in the retention of masonry façades

Against a background of major anxiety over safety in the construction industry, and an increase and interest in refurbishment work in general, this project is aimed at providing authoritative guidance on façade retention for the building team as a whole and to be used on schemes of varying size and complexity.

Two reports are being produced, to be published in summer 2003. The main report, *The retention of masonry façades: Best practice guidance,* is an extensive and comprehensive book that covers all aspects of the subject. It will include information on planning and strategy, health and safety, investigations of the façade of an adjacent structure, and the design of the façade retention arrangements.

Key recommendations are given for both organisation and technical areas. The issue of responsibility and the importance of maintaining a continuous thread through the various stages of concept, design and implementation are considered. The guide deals with the implications of both advance temporary works contracts and the particular case where new construction behind the retained façade is delayed for a significant period.

Recommended values for deflection limits and lateral design loads are also presented. Selected case studies cover a variety of façades retained using different systems and configurations on projects of different sizes and complexity. A step-by-step calculation for the wind loads on a façade using BS 6399-2 and a worked example are included.

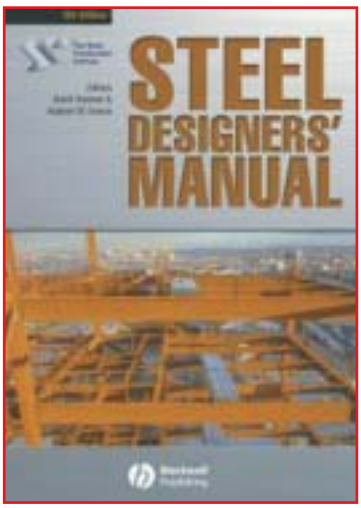
The second report, *Practical guide to retention of masonry façades,* looks specifically at the issues encountered during the implementation of such schemes, drawing on material from the main report and is intended to be an essential part of site documentation. It contains a number of relevant checklists, list of references and site-specific guidance, together with material intended for use as site induction talks for site operatives.

The Health and Safety Executive and CIRIA are joint sponsors of the project and the research contractor is Ove Arup and Partners.

For further information please contact CIRIA (020 7222 8891; fax: 020 7222 1708; E-mail: irf@ciria.org; website: www.ciria.org).

Steel Designers' Manual – 6th edition

The new 6th edition of this essential manual on structural steelwork design is now available in hardback.



All chapters have been comprehensively revised to take account of recent research and other developments in practice, and include:

- text and worked examples revised in accordance with BS 5950-1: 2000 and BS 5400-3: 2000;
- a completely new chapter on brittle fracture and fatigue;
- a new chapter on simple and moment connections;
- a new chapter on sustainability and steel;
- a new chapter on Eurocodes, summarising the principal differences between them and the current national standards;
- a rewritten chapter on steel piling.

To purchase a copy (£89.50 + p&p) online please contact www.steelbiz.org/shop or contact the Publications Deptartment, The Steel Construction Institute (01344 872775; E-mail: publications@steel-sci.com).

The changing face of DFID research

The role and management of DFID research will change from April 2003 with the establishment of a new Central Research Group. This reflects the recommendations of a review undertaken in 2002 *Research for Poverty Reduction: a DFID Research Policy Paper*, see the DFID website http://www.dfid.gov.uk. for a copy

Engineering research has always played an important role in DFID's research programme and the Engineering Knowledge and Research (E-KaR) programme will be assimilated into the new Central Research Group. The E-KaR projects will be gradually phased into a three-themed approach to alleviating world poverty. This will involve:

- close co-operation with international efforts focused on solving problems that inhibit poor peoples' economic opportunity to rise from poverty;
- addressing demand-led, in-country-identified problems that restrict or hinder anti-poverty initiatives;
- being responsive to ideas for research in medium and long-term frameworks and also to include 'blue sky' opportunities.

For 2003/4, the E-KaR programme will have two funding mechanisms.

- ***Directed activity:*** addressing key aspects through commissioned KaR activities. The identification and prioritisation of specific knowledge gaps will be directed by in-country sources for demand-led problem-solving and by UK DFID Advisers for policy analysis.
- ***Responsive fund:*** to be used flexibly to address innovative ideas; specific dissemination, network-forming, or scoping activities; and 'blue sky' research.

Typical study areas are likely to include policy analysis for providing information for decision makers and policy makers, trials for project content development and pro-poor innovation.

Dissemination will be a key component of research projects and the major emphasis for existing and proposed work will be on the formation of knowledge networks, uptake pathways, to gather knowledge and to disseminate the findings of research, to be able to offer an enquiry service and to disseminate its existence.

Information on current research projects can be found in the Engineering Knowledge and Research Progress Report for 2002 or electronically via the Infrastructure website http://www.infrastructureconnect.info/.

For further information or to propose research studies, contact Peter O'Neill at DFID (020-7023-1227; E-mail p-oneill@dfid.gov.uk).

DFID Department for International Development

AggRegain: new independent information source on recycled and secondary aggregates

dti Department of Trade and Industry

On Tuesday 4 February 2003, WRAP (the Waste and Resources Action Programme) launched AggRegain, a unique 'one-stop' source of independent information, designed to assist anyone interested in specifying, purchasing or supplying recycled or secondary aggregates.

Funded through the Aggregates Levy Sustainability Fund, AggRegain is a free service that consists of a website and a telephone helpline. It will help increase the usage of recycled and secondary aggregates by providing:

- more than 50 detailed case studies illustrating the cost savings and performance benefits of using recycled and secondary aggregates in housing development, commercial buildings and infrastructure projects;
- technical notes to assist in the specification of recycled and secondary aggregates;
- a comprehensive directory of over 250 suppliers operating from more than 350 sites;
- a powerful search facility across 150 specially selected sites providing information on recycled and secondary aggregates.

About 214 million tonnes of aggregate are used in England each year in construction, of which 50 million tonnes come from recycled and secondary sources. Major construction projects such as the Channel Tunnel Rail Link and Heathrow Terminal 5 are high profile examples of where these materials are being used. Even though sustainable aggregates satisfy approximately 23 per cent of the demand for aggregates in England, there is so much more that could – and needs – to be done to reduce consumption of primary materials.

If demand for aggregate increases by an expected one per cent per annum, an extra 20 million tonnes a year will be needed by 2012. This additional demand can either be satisfied by extracting further primary aggregates or by following a more-sustainable route through continuing to increase the use of recycled and secondary aggregates.

This more environmentally positive option is achievable. To do this, two issues need to be addressed. Firstly, the infrastructure for reprocessing construction, demolition and excavation wastes has to be improved, capturing those resources still being lost to landfill, and better utilisation made of secondary resources.

WRAP believes that a second major barrier to the wider use of recycled and secondary aggregates is the lack of a comprehensive, independent source of information, upon which buyers can base procurement decisions and suppliers can use as a 'shop window' to promote the availability of products. Greater awareness also needs to be made of the fact that recycled and secondary aggregates can generate cost savings (price, waste disposal and transport) compared to primary aggregates, and that they are fit for purpose for most applications. This is exactly what the AggRegain service will do.

The AggRegain website also contains a news section, which will keep visitors informed of the latest industry developments relating to the use of recycled and secondary aggregates, and there is an optional facility for visitors to register on the site to ensure that they are e-mailed with news of new developments as they occur. Links have also been established with other websites that contain information of interest to specifiers, purchasers and suppliers.

For further information on AggRegain contact the free helpline (0808 100 2040) or visit www.aggregain.org.uk.

For further information on WRAP please contact John Barritt (E-mail: john.barritt@wrap.org.uk).

Steep slope landfill linings

ICE

An EPSRC-funded project, part of the Waste & Pollution Management Programme, has investigated factors that influence structural integrity of landfill lining systems constructed on steep slopes. The aim is to ensure performance of the landfill gas and leachate barrier throughout the landfill design life.

The European Landfill Directive has established the requirement to demonstrate stability and integrity of the lining system. Interaction between the waste and the liner controls the structural behaviour but, to date, there is little published information on the waste properties required to assess designs or on the structural performance of the barrier in service.

The current project has entailed obtaining relevant mechanical waste properties, instrumentation of a lining system during staged construction, and using the information from these to develop and validate a numerical model for assessing waste-barrier interaction.

Instrumentation of Landfill Barrier

A method for carrying out pressuremeter tests in municipal solid waste (MSW) has been developed in collaboration with Cambridge Insitu and Golder Associates. Tests have been conducted at a range of depths in fresh and partially degraded waste. Unload-reload loops have been used to obtain values of shear stiffness. The results demonstrate that engineering properties of MSW vary in a consistent and predictable way.

Instrumentation of a 25-metre high mineral liner, constructed in lifts against an 80° quarry wall, has provided information on barrier deformations and on stresses at the boundary between the barrier and waste. In addition, information has been obtained on constrained stiffness and K_0 values for MSW. The results are being used to validate a numerical model for assessing waste-barrier interaction. The findings from this study are contributing to the development of Environment Agency guidance on assessment of landfill stability.

For further information contact Dr Neil Dixon at the Department of Civil and Building Engineering, Loughborough University (01509 228542; Email: N.Dixon@lboro.ac.uk).

Building envelope acoustics

Acoustic performance of building envelopes is of greater concern on a growing number of projects. This arises from response to demands for higher comfort levels as well as the need for a healthy and efficient workplace or dwelling. Particular demands arise when commercial buildings are converted to dwellings and when inner city sites are redeveloped.

Traditionally the method of controlling sound transmission through the building envelope has been to adopt a heavy form of construction and punched out windows with a high acoustic performance.

Today it is realised that the acoustic performance of even lightweight walls can be improved. The use of heavier glasses, acoustic laminated glasses and acoustic trickle ventilators can all improve the sound reduction of a façade along with improved sealing of the wall.

A further issue with building envelopes is the potential for flanking transmission at the envelope to allow unacceptable passage of sound from one compartment of the building to another. The new Part E of the Building Regulations (England and Wales) places a greater emphasis on this aspect of the sound environment in dwellings.

In response to the specification of acoustically improved building façades, test houses are today able to test larger areas of façades and collections of façade components. The need to verify performance has also led to an increase in the use of field-testing to prove the sound insulation of as-constructed façades.

Acoustic testing of a façade assembly.
Courtesy of Taylor Woodrow Construction

To fill the demand for guidance from clients, specifiers and contractors, the CWCT has produced a series of Technical Notes on the acoustic performance of building envelopes. The series covers the basic principles of acoustics, the performance of different components, and calculation and assessment of the performance of a curtain wall or similar, comprising several components or elements. Guidance on the current British and European standards is also given. The Technical Notes are:

- TN 37 *Introduction to building envelope acoustics*;
- TN 38 *Acoustic performance of windows*;
- TN 39 *Sound transmission through building envelopes*;
- TN40 *Sound environment behind a building envelope.*

These form part of a larger series of Technical Notes on cladding and the building envelope.

For further information on this project, please contact Brian Tandy at SCI (E-mail: b.tandy@steel-sci.com) or Stephen Ledbetter at CWCT (E-mail: cwct@bath.ac.uk). The websites for further information are: CWCT (www.cwct.co.uk), SCI (www.sci.org.uk) and WRAP (www.wrap.org.uk).

Increasing the value of UK-grown timber

BRE has been examining timber jointing techniques in order to help enhance the economic potential of UK-grown timber. This has included work to improve timber's performance as a structural material in construction.

The amount of British-grown timber available to the UK market is forecast to increase markedly in the coming years. Recent research has been aiming to enhance its quality and performance. This includes the use of jointing techniques to help a greater proportion of timber production meet the more demanding criteria in higher-value markets.

British-grown spruce and pine have the potential to produce high quality structural material, but must meet specific criteria related to strength, straightness and presentation. Much UK grown material is already used in floor joists and timber frame elements. However, by using new wet (or dry) gluing technology (end-, edge- and face-jointing), softwood can be re-engineered into products with improved and tailored characteristics. For example, timber battens that have defects cut from them can be re-engineered into higher strength products. Another example is that short lengths of timber can be end-jointed into battens of any length. The technique enables strength, straightness and dimensions of products to be closely controlled and enhanced.

Conventional adhesives can only be used to glue dry timber at room temperature and, before jointed components can be robustly moved, the adhesive needs to be cured for some time under pressure or by using high energy curing techniques. The new adhesive systems are effective on wet, unseasoned timber as well as on dry timber.

BRE has evaluated the potential of two wet gluing systems:

- the brown-coloured GreenweldTM adhesive system initially developed and patented by the New Zealand Forest Research Institute (NZFRI);
- an adhesive system based on a clear polyurethane.

The GreenweldTM system is effective at any temperature and self-cures in minutes. The polyurethane system takes a little longer to initially cure. Although the GreenweldTM adhesive gives a brown glue line, once the jointed components are stained or painted the joint is partially or completely obscured. The polyurethane system gives a colourless joint, which becomes almost invisible when wood components are end-matched to give an appearance of continuous natural grain.

Assessments at BRE have so far demonstrated that the GreenweldTM adhesive system has adequate strength and durability for external structural use. Further work is still required before the polyurethane system can be used with confidence for structural applications.

Potential structural products that can be manufactured from green-glued timber are:

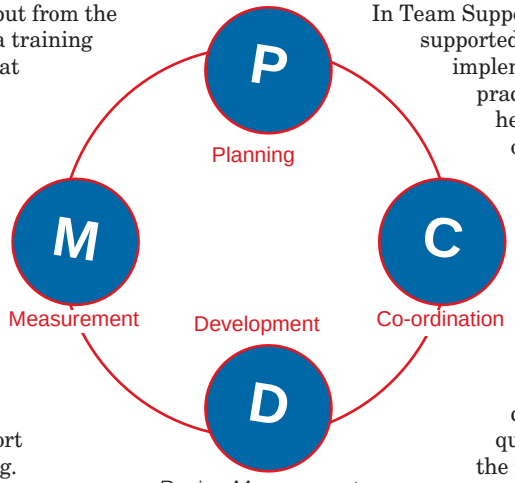
- straight battens produced by re-engineering (by cutting in half and re-orientating before face- or edge-gluing) boxed pith battens (which currently have excessive twist);
- straight battens produced by cutting out strength-reducing defects from reject battens and end-jointing the good pieces;
- bespoke length battens from end-jointed shorter material;
- higher grade material produced from a low structural grade by defect cutting and re-assembly.

For more information please contact Keith Maun at BRE (01923 664812; fax: 01923 664785; E-mail: maunk@bre.co.uk).

Design management at Skanska

The construction industry has over recent years recognised the potential for effective design management to contribute to project success. However, due to the speed at which projects must be delivered, the complexity of the process and lack of accepted good practice, successfully managing the design process is very challenging. Therefore, three years ago a partnership of Loughborough University, Skanska and EPSRC began investigating and developing ways of improving the delivery and effectiveness of the design management process.

The principal output from the investigation is a training initiative aimed at improving design management practice throughout Skanska by equipping employees with the skills and tools to manage today's fast moving and demanding projects. It comprises a Design Management Handbook, Design Management Training, Team Support and Project Monitoring.



Design Management Tool Lexicon

The 256-page Handbook addresses critical aspects of design management practice and provides a suite of 25 tools together with supporting notes on key management issues. The Handbook is provided on each project and the company Intranet. Training on the tools and practices is provided to project teams throughout the company, covering about 600 employees.

Involvement of the whole project team in the initiative is critical. Design management requires the timely input of all project team members and therefore it is essential that they are aware of design management processes and where they would be expected to contribute. Failure to address this is a major barrier to effective design management.

In Team Support, project teams are supported in the implementation of the new practices and tools to help embed new ways of working in company practice. Project Monitoring is establishing the impact on project performance of the new practices to demonstrate that they are working and thus reinforce change. The quantitative impacts of the new practices are presented through a set of innovative Design Process Performance Indicators (DPPIs) developed specifically for the research project. We are also identifying the uptake of the tools and, from this, understanding the barriers to implementing new design management methods and how they can be overcome. These findings are being reported in industry journals and the work will be completed in October 2003.

For further information please contact Lee Bibby, Simon Austin or Dino Bouchlaghem at Centre for Innovative Construction Engineering, (01509 228549; E-mail: lee.bibby@skanska.co.uk; website: www.cice.org.uk).

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